PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-161064
(43)Date of publication of application : 19.06.1998

(51)Int.CI. G02B 27/28
G02B 27/10
G02F 1/13
G02F 1/1335

(21)Application number : 08-319325
(22)Date of filing : 29.11.1996

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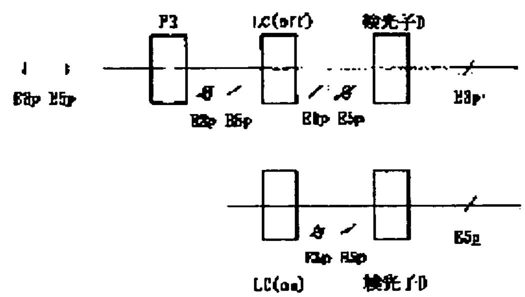
(72)Inventor : YAMAURA HITOSHI

(54) DEVICE AND METHOD FOR LIGHT SEPARATION

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an alignment-free light separating device and its method which have no mechanical driving part and is hardly affected by temperature variation and temporal variation.
SOLUTION: (p)-Polarized light of 1.3μm in wavelength before being made incident on a Faraday rotator FR is denoted as E3p and (p)-polarized light of 1.5μm in wavelength is denoted as E5p. The direction of polarization of E3p which is made incident on the Faraday rotator FR is rotated by 560deg and the direction of polarization of E5p is rotated by 470deg, so that their azimuth angles of polarization are 20 and 110deg respectively. When E3p and E5p are made incident on a liquid crystal cell LC in an OFF state, they are rotated by 90deg respectively. When E3p and E5p are made incident on an analyzer D, only E3p having the matching azimuth angle of polarization is passed. When E3p and E5p are made incident on the liquid crystal cell LC in an ON state, neither beam changes in the direction of polarization. When E3p and E5p are made incident on the analyzer D, only E5p having the matching azimuth angle of polarization is passed.



LEGAL STATUS
[Date of request for examination]
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
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CLAIMS

[Claim(s)]
[Claim 1] In the optical decollator which chooses and carries out outgoing radiation of one or more wavelength components in the incident light which has two or more wavelength components The optical decollator characterized by having a wavelength segregation means to separate the above-mentioned wavelength component of the predetermined polarization direction in the above-mentioned incident light which passed the plane-of-polarization rotation means which is made to rotate the plane of polarization of the above-mentioned incident light, and carries out outgoing radiation at a different include angle for every wavelength component, and this plane-of-polarization rotation means.
[Claim 2] The optical decollator according to claim 1 characterized by for the above-mentioned plane-of-polarization rotation means making the polarization direction of at least two above-mentioned wavelength components intersect perpendicularly, and carrying out outgoing radiation.
[Claim 3] The optical decollator according to claim 1 or 2 with which the above-mentioned plane-of-polarization rotation means is characterized by being a faraday rotator.
[Claim 4] It has further the plane-of-polarization adjustable means which can change the polarization direction of at least two above-mentioned wavelength components in the above-mentioned incident light which passed the above-mentioned plane-of-polarization rotation means. An optical decollator given in any of claims 1-3 characterized by choosing the above-mentioned wavelength component separated by the above-mentioned wavelength segregation means by whether this plane-of-polarization adjustable means changes the direction of the plane of polarization of the above-mentioned wavelength component they are.
[Claim 5] In the optical decollator which chooses and carries out outgoing radiation of one or more wavelength components in the incident light which has two or more wavelength components A polarization separation means to separate into the 1st polarization which has the polarization direction which intersects the above-mentioned incident light perpendicularly mutually, and the 2nd polarization, The 1st plane-of-polarization rotation means which is made to rotate the plane of polarization of polarization of the above 1st, and carries out outgoing radiation at a different include angle for every wavelength component, The 1st wavelength segregation means which separates the above-mentioned wavelength component of the predetermined polarization direction in polarization of the above 1st which passed this 1st plane-of-polarization rotation means, The 2nd plane-of-polarization rotation means which is made to rotate the plane of polarization of polarization of the above 2nd, and carries out outgoing radiation at a different include angle for every wavelength component, The optical decollator characterized by having the 2nd wavelength segregation means which separates the above-mentioned wavelength component of the predetermined polarization direction in polarization of the above 2nd which passed this 2nd plane-of-polarization rotation means.
[Claim 6] The optical decollator according to claim 5 characterized by making the polarization direction of at least two above-mentioned wavelength components in polarization of the above 1st intersect perpendicularly, carrying out outgoing radiation, and for the plane-of-polarization rotation means of the above 1st making the polarization direction of at least two above-mentioned wavelength components in polarization of the plane-of-polarization rotation means of the above 2nd of the above 2nd intersect perpendicularly, and carrying out outgoing radiation.
[Claim 7] the above 1st -- and -- or the optical decollator according to claim 5 or 6 with which the 2nd plane-of-polarization rotation means is characterized by being a faraday rotator.
[Claim 8] the 1st plane-of-polarization adjustable means which can change the polarization direction of at least two above-mentioned wavelength components in polarization of the above 1st which passed the above-mentioned 1st plane-of-polarization rotation means -- and Or it has further the 2nd plane-of-polarization

adjustable means which can change the polarization direction of at least two above-mentioned wavelength components in polarization of the above 2nd which passed the above-mentioned 2nd plane-of-polarization rotation means. this 1st [the] -- and -- or a ****** [that the 2nd plane-of-polarization adjustable means changes the direction of the plane of polarization of the above-mentioned wavelength component] -- the above 1st -- and -- or an optical decollator given in any of claims 5-7 characterized by choosing the above-mentioned wavelength component separated by the 2nd wavelength segregation means they are.

[Claim 9] The optical separation approach characterized by rotating the plane of polarization of the above-mentioned incident light at a different include angle for every wavelength component in the optical separation approach which chooses and carries out outgoing radiation of one or more wavelength components in the incident light which has two or more wavelength components, and separating the above-mentioned wavelength component of the predetermined polarization direction in the above-mentioned incident light.

[Claim 10] In the optical separation approach which chooses and carries out outgoing radiation of one or more wavelength components in the incident light which has two or more wavelength components Divide into the 1st the polarization and the polarization of the 2nd which have the polarization direction which intersects the above-mentioned incident light perpendicularly mutually, rotate the plane of polarization of polarization of the above 1st at a different include angle for every wavelength component, and the above-mentioned wavelength component of the predetermined polarization direction in polarization of the above 1st is separated. The optical separation approach characterized by rotating the plane of polarization of polarization of the above 2nd at a different include angle for every wavelength component, and separating the above-mentioned wavelength component of the predetermined polarization direction in polarization of the account 2nd of the above.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention can be especially applied to optical measurement, optical information processing, etc. about the optical decollator which chooses and carries out outgoing radiation of one or more wavelength components in the incident light which has two or more wavelength components, and its approach.
[0002]
[Description of the Prior Art] In recent years, the highly precise optical measurement using the properties (a phase, polarization, wavelength, etc.) of light attracts attention, and the approach of taking out the light of predetermined wavelength from the incident light in which the light of two or more wavelength is contained alternatively is studied.
[0003] There are some which take out the light of predetermined wavelength alternatively by rotating a diffraction grating and an interference filter mechanically as the conventional optical separation approach, for example.
[0004] Moreover, there were an approach of in addition to this changing cavity length mechanically using the property that a Fabry-Perot resonator penetrates only resonant wavelength, and a method of changing the optical path length by pouring liquid crystal etc. into the interior and changing a refractive index electrically.

[0005]
[Problem(s) to be Solved by the Invention] However, when there was a mechanical drive like before, the problem was in stability by mechanical gap etc.
[0006] Moreover, by the approach using liquid crystal etc., there was a problem that the gap of liquid crystal changed and resonant wavelength was not stabilized by the temperature change or aging of liquid crystal even if there is no mechanical drive.
[0007] this invention is made in order to solve the above-mentioned trouble -- having -- a mechanical mechanical component -- there is nothing -- the effect of a temperature change or aging -- winning popularity -- hard -- alignment -- it aims at offering a free light decollator and its approach.
[0008]
[Means for Solving the Problem] In the optical decollator which invention of claim 1 chooses one or more wavelength components in the incident light which has two or more wavelength components, and carries out outgoing radiation It is characterized by having a wavelength segregation means to separate the above-mentioned wavelength component of the predetermined polarization direction in the above-mentioned incident light which passed the plane-of-polarization rotation means which is made to rotate the plane of polarization of the above-mentioned incident light, and carries out outgoing radiation at a different include angle for every wavelength component, and this plane-of-polarization rotation means.
[0009] Invention of claim 2 is characterized by for the above-mentioned plane-of-polarization rotation means making the polarization direction of at least two above-mentioned wavelength components intersect perpendicularly, and carrying out outgoing radiation in an optical decollator according to claim 1.
[0010] Invention of claim 3 is characterized by the above-mentioned plane-of-polarization rotation means being a faraday rotator in an optical decollator according to claim 1 or 2.
[0011] Invention of claim 4 is set to an optical decollator given in any of claims 1-3 they are. It has further the plane-of-polarization adjustable means which can change the polarization direction of at least two above-mentioned wavelength components in the above-mentioned incident light which passed the above-mentioned plane-of-polarization rotation means. This plane-of-polarization adjustable means is

characterized by choosing the above-mentioned wavelength component separated by the above-mentioned wavelength segregation means by whether the direction of the plane of polarization of the above-mentioned wavelength component is changed.
[0012] In the optical decollator which invention of claim 5 chooses one or more wavelength components in the incident light which has two or more wavelength components, and carries out outgoing radiation A polarization separation means to separate into the 1st polarization which has the polarization direction which intersects the above-mentioned incident light perpendicularly mutually, and the 2nd polarization, The 1st plane-of-polarization rotation means which is made to rotate the plane of polarization of polarization of the above 1st, and carries out outgoing radiation at a different include angle for every wavelength component, The 1st wavelength segregation means which separates the above-mentioned wavelength component of the predetermined polarization direction in polarization of the above 1st which passed this 1st plane-of-polarization rotation means, It is characterized by having the 2nd wavelength segregation means which separates the above-mentioned wavelength component of the predetermined polarization direction in polarization of the above 2nd which passed the 2nd plane-of-polarization rotation means which is made to rotate the plane of polarization of polarization of the above 2nd, and carries out outgoing radiation at a different include angle for every wavelength component, and this 2nd plane-of-polarization rotation means.
[0013] In an optical decollator according to claim 5, the plane-of-polarization rotation means of the above 1st makes the polarization direction of at least two above-mentioned wavelength components in polarization of the above 1st intersect perpendicularly, and carries out outgoing radiation of the invention of claim 6. It is characterized by for the plane-of-polarization rotation means of the above 2nd making the polarization direction of at least two above-mentioned wavelength components in polarization of the above 2nd intersect perpendicularly, and carrying out outgoing radiation.
[0014] invention of claim 7 -- an optical decollator according to claim 5 or 6 -- setting -- the above 1st -- and -- or the 2nd plane-of-polarization rotation means is characterized by being a faraday rotator.
[0015] Invention of claim 8 is set to an optical decollator given in any of claims 5-7 they are. the 1st plane-of-polarization adjustable means which can change the polarization direction of at least two above-mentioned wavelength components in polarization of the above 1st which passed the above-mentioned 1st plane-of-polarization rotation means -- and Or it has further the 2nd plane-of-polarization adjustable means which can change the polarization direction of at least two above-mentioned wavelength components in polarization of the above 2nd which passed the above-mentioned 2nd plane-of-polarization rotation means. this 1st [the] -- and -- or a ****** [that the 2nd plane-of-polarization adjustable means changes the direction of the plane of polarization of the above-mentioned wavelength component] -- the above 1st -- and -- or it is characterized by choosing the above-mentioned wavelength component separated by the 2nd wavelength segregation means.
[0016] In the optical separation approach which chooses and carries out outgoing radiation of one or more wavelength components in the incident light which has two or more wavelength components, invention of claim 9 rotates the plane of polarization of the above-mentioned incident light at a different include angle for every wavelength component, and is characterized by separating the above-mentioned wavelength component of the predetermined polarization direction in the above-mentioned incident light.
[0017] In the optical separation approach which invention of claim 10 chooses one or more wavelength components in the incident light which has two or more wavelength components, and carries out outgoing radiation Divide into the 1st the polarization and the polarization of the 2nd which have the polarization direction which intersects the above-mentioned incident light perpendicularly mutually, rotate the plane of polarization of polarization of the above 1st at a different include angle for every wavelength component, and the above-mentioned wavelength component of the predetermined polarization direction in polarization of the above 1st is separated. The plane of polarization of polarization of the above 2nd is rotated at a different include angle for every wavelength component, and it is characterized by separating the above-mentioned wavelength component of the predetermined polarization direction in polarization of the account 2nd of the above.
[0018]
[Embodiment of the Invention] Hereafter, the gestalt of operation of the optical decollator by this invention and its approach is explained to a detail, referring to a drawing.
[0019] (Example 1) This example is an example when carrying out incidence of the linearly polarized light which has two wavelength components, 1.3 micrometers and 1.5 micrometers, and taking out a predetermined wavelength component alternatively.
[0020] Drawing 1 shows the configuration of this example and consists of the faraday rotator FR, a liquid

crystal cell LC, and an analyzer D. Moreover, O|/phi shows the polarization direction, respectively, in O, O, and a direction perpendicular to both opticals axis and/show the direction of [between O and |], and, as for a direction perpendicular to space, and |, phi shows the direction perpendicular to both / and an optical axis.
[0021] A faraday rotator rotates the plane of polarization of incident light for every wavelength component by the wavelength dispersion of the number of Velde. Faraday medium (BiYbTb) 3 Fe 5O12 with a thickness of 3915 micrometers was used for the faraday rotator FR of this example. In addition, although not illustrated, in faraday medium (BiYbTb) 3 Fe 5O12, it is the role 1100 more than a saturation magnetic field with a wavelength of 1.5 micrometers. The magnet for forming Oe magnetic field was used. The faraday rotator FR carries out 560deg rotations of the plane of polarization of light with a wavelength of 1.3 micrometers, and carries out 470deg rotations of the plane of polarization of light with a wavelength of 1.5 micrometers. Therefore, the polarization direction of light with a wavelength [when passing the faraday rotator FR] of 1.3 micrometers and light with a wavelength of 1.5 micrometers is shifted 90 deg.
[0022] Drawing 2 shows the condition of the polarization direction when seeing from the travelling direction of light when passing the faraday rotator FR.
[0023] The polarization direction of the light with a wavelength of 1.3 micrometers in front of incidence and the light of wavelength with a wavelength of 1.5 micrometers is a x axis and parallel at the faraday rotator FR. The polarization direction of light with a wavelength [when passing the faraday rotator FR] of 1.3 micrometers carries out 560(360+200) deg rotations, and becomes in the direction shown by ** in drawing. Moreover, the polarization direction of light with a wavelength [when passing the faraday rotator FR] of 1.5 micrometers carries out 470(360+110) deg rotations, and becomes in the direction shown by ** in drawing. The include angle (drawing 1 110 deg(s)) of the include angle which polarization and a x axis make, for example, **, the include angle (drawing 1 20 deg(s)) and ** which a x axis makes, and a x axis to make is called a polarization azimuth below. In addition, if the front flesh side of a faraday rotator is used conversely, the hand of cut of plane of polarization will become reverse, and **** will become the position of symmetry centering on a x axis.
[0024] Cel thickness is about 10 micrometers and the pneumatic liquid crystal of the twist array in which the direction of a liquid crystal major axis was twisted 90 degs between substrates is used for liquid crystal cell LC. Liquid crystal cell LC carried out 90deg rotations of the polarization direction of polarization of polarization azimuth 20deg and 110deg(s) by the OFF state, and by the ON state, it is arranged so that the polarization direction of both polarization may not be changed.
[0025] Analyzer D passes only polarization of a predetermined polarization azimuth, and by this example, it was set up so that polarization of polarization azimuth 110deg might be passed.
[0026] The case where 1.5-micrometer p-polarized light (the direction of |) carries out incidence to the wavelength of 1.3 micrometers is made into an example, and such a configuration explains. E3p and p-polarized light with a wavelength of 1.5 micrometers are set to E5p for the p-polarized light with a wavelength of 1.3 micrometers in front of the incidence to the faraday rotator FR.
[0027] The polarization direction of the beam of E3p which carried out incidence to the faraday rotator FR carries out 560deg rotations, the polarization direction of the beam of E5p carries out 470deg rotations, and each polarization azimuth is set to 20deg(s) and 110deg(s).
[0028] If the beam of E3p and the beam of E5p carry out incidence to liquid crystal cell LC at the time of an OFF state, 90 degs will rotate at a time, respectively. If the beam of E3p and the beam of E5p carry out incidence to Analyzer D, only the beam of E3p whose polarization azimuth corresponded will pass.
[0029] Moreover, if the beam of E3p and the beam of E5p carry out incidence to liquid crystal cell LC at the time of an ON state, the polarization direction of a beam will not change, respectively. If the beam of E3p and the beam of E5p carry out incidence to Analyzer D, only the beam of E5p whose polarization azimuth corresponded will pass.
[0030] Thus, the wavelength of the light to take out can be chosen by turning on and off of LC of a liquid crystal cell.
[0031] Since the polarization direction of incident light is rotated for every wavelength component by the faraday rotator FR and it was made to pass only polarization of a predetermined polarization azimuth with Analyzer R as mentioned above according to this example, it becomes nothing mechanical driving to take out the light of predetermined wavelength possible. Furthermore, what (it changes) the wavelength of the light to take out is chosen for by using liquid crystal cell LC becomes possible.
[0032] Moreover, since the include angle of 90deg(s) is given by the faraday rotator FR between wavelength, it becomes possible to separate the light of two wavelength completely.
[0033] The optical decollator of this example cannot be easily influenced of a temperature change or aging

compared with conventional equipment.
[0034] (Example 2) This example is an example when carrying out incidence of the light (you not being the linearly polarized light) which has two wavelength components, 1.3 micrometers and 1.5 micrometers, and taking out a predetermined wavelength component alternatively.
[0035] Drawing 3 shows the configuration of this example and consists of two rutile prism R1 and R2, a faraday rotator FR, and 1/2 wavelength-plate lambda / 2 and liquid crystal cell LC. Moreover, O|/phi shows the polarization direction, respectively, in O, O, and a direction perpendicular to both opticals axis and/show the direction of [between O and |], and, as for a direction perpendicular to space, and |, phi shows the direction perpendicular to both / and an optical axis.
[0036] The 1st rutile prism R1 is divided into two polarization (s-polarized light and p-polarized light) which has the polarization direction which intersects incident light perpendicularly mutually.
[0037] A faraday rotator rotates the plane of polarization of light for every wavelength component by the wavelength dispersion of the number of Velde. Faraday medium (BiYbTb) 3 Fe 5O12 with a thickness of 3915 micrometers was used for the faraday rotator FR of this example. In addition, although not illustrated, in faraday medium (BiYbTb) 3 Fe 5O12, it is the role 1100 more than a saturation magnetic field with a wavelength of 1.5 micrometers. The magnet for forming Oe magnetic field was used. The faraday rotator FR carries out 560deg rotations of the plane of polarization of light with a wavelength of 1.3 micrometers, and carries out 470deg rotations of the plane of polarization of light with a wavelength of 1.5 micrometers. Therefore, the polarization direction of light with a wavelength [when passing the faraday rotator FR] of 1.3 micrometers and light with a wavelength of 1.5 micrometers is shifted 90 deg.
[0038] lambda/2 is 1 / thing which rotates the polarization direction 2 wavelength plate. The detail is explained referring to drawing 4 . 1 / direction (polarization azimuth 20deg) which shows the polarization direction of light with a wavelength [in front of incidence] of 1.3 micrometers to lambda/2 by ** in drawing 2 wavelength plate, and the polarization direction of light with a wavelength of 1.5 micrometers have become in the direction (polarization azimuth 110deg) shown by ** in drawing. In this example, lambda/2 is installed in 1 / include angle to which the optical axis inclined 10 degs to the x axis 2 wavelength plate. Since there is 1 / a property which carries out and carries out outgoing radiation of the polarization direction of incident light to a symmetric position to an optical axis lambda/2 2 wavelength plate, if 1/2 wavelength-plate lambda / 2 are passed, the light of the direction of ** will become a x axis and parallel, and the light of the direction of ** will become the y-axis and parallel. That is, both the polarization azimuths of 1 / light with a wavelength of 1.3 micrometers which passed lambda/2 2 wavelength plate, and light with a wavelength of 1.5 micrometers carry out -20deg rotation.
[0039] Cel thickness is about 10 micrometers and the pneumatic liquid crystal of the twist array in which the direction of a liquid crystal major axis was twisted 90 degs between substrates is used for liquid crystal cell LC. Liquid crystal cell LC carried out 90deg rotations of the polarization direction of polarization of polarization azimuth 20deg and 110deg(s) by the OFF state, and by the ON state, it is arranged so that the polarization direction of both polarization may not be changed.
[0040] The 2nd rutile prism R2 multiplexs the separated light, it made inside-out the same thing as the 1st rutile prism R1, and it was used for it.
[0041] The case where 1.5-micrometer light carries out incidence to the wavelength of 1.3 micrometers is made into an example, and such a configuration explains. E3p and s-polarized light with a wavelength of 1.5 micrometers are set, and p-polarized light is set [the s-polarized light with a wavelength of 1.3 micrometers in front of the incidence to the faraday rotator FR] to E5p for p-polarized light E5s E3s.
[0042] First, incident light is separated into s-polarized light (E3s, E5s) and p-polarized light (E3p, E5p) by the 1st rutile prism R1.
[0043] The polarization direction of the beam of E3s and E3p which carried out incidence to the faraday rotator FR carries out 560deg rotations, the polarization direction of the beam of E5s and E5p carries out 470deg rotations, and each polarization azimuth is set to 20deg(s) and 110deg(s).
[0044] Next, if E3p and E5p carry out incidence to 1/2 wavelength-plate lambda / 2 each beam E3s and E5s, a polarization azimuth will carry out -20deg rotation, respectively, the polarization azimuth of the beam of E3s and E3p is set to 0deg, and the polarization azimuth of the beam of E5s and E5p is set to 90deg(s).
[0045] If E3p and E5p carry out incidence to liquid crystal cell LC at the time of an OFF state each beam E3s and E5s, 90 degs rotate at a time, respectively, E3p and E5s, it will become s-polarized light to the 2nd rutile prism R2, and the 2nd rutile prism R2 will be penetrated straightly. On the other hand, E3s and E5p become p-polarized light to the 2nd rutile prism R2, and an optical path is bent in the 2nd rutile prism R2. Consequently, from the 2nd rutile prism R2, outgoing radiation of E3p, E5 second+E5p, and the three E3s

beams will be carried out, and, as for E5 second+E5p, light with a wavelength [in incident light] of 1.5 micrometers was taken out.
[0046] Moreover, if E3p and E5p carry out incidence to liquid crystal cell LC at the time of an ON state each beam E3s and E5s, since the polarization direction of a beam will not change, respectively, E3s and E5p become s-polarized light to the 2nd rutile prism R2, and penetrate the 2nd rutile prism R2 straightly. On the other hand, E3p and E5s, it becomes p-polarized light to the 2nd rutile prism R2, and an optical path is bent in the 2nd rutile prism R2. Consequently, from the 2nd rutile prism R2, outgoing radiation of E5p, E3 second+E3p, and the three E5s beams will be carried out, and, as for E3 second+E3p, light with a wavelength [in incident light] of 1.5 micrometers was taken out.
[0047] Thus, the wavelength of the light to take out can be chosen by turning on and off of LC of a liquid crystal cell.
[0048] As mentioned above, according to this example, the 1st rutile prism R1 separates into s-polarized light and p-polarized light, the polarization direction of light is rotated for every wavelength component by the faraday rotator FR, and since a polarization azimuth is adjusted by lambda/2 2 wavelength plate and light was made to multiplex by the 2nd rutile prism, it becomes nothing mechanical driving 1 / to take out the light of predetermined wavelength possible. In this example, incident light may not be the linearly polarized light. Furthermore, what (it changes) the wavelength of the light to take out is chosen for by using liquid crystal cell LC becomes possible.
[0049] The optical decollator of this example cannot be easily influenced of a temperature change or aging compared with conventional equipment.
[0050] This invention is not limited to the above-mentioned example, and permits various deformation.
[0051] Although light with a wavelength of 1.3 micrometers and light with a wavelength of 1.5 micrometers were made into the example and the above-mentioned example explained them, this invention is applicable also like the light of other wavelength. For example, the wavelength of 633nm, a 515nm HeNe laser beam, and argon laser light are applicable also like a discontiguous selection.
[0052] Moreover, other things except the above-mentioned example having shown may be used also about the class of faraday medium, and its thickness.
[0053] Although the thickness of a faraday medium is specified and the angle of rotation of plane of polarization was controlled by the above-mentioned example since the saturation magnetic field was used, you may make it control an angle of rotation by changing a magnetic field. However, when changing a magnetic field, it is desirable to change the magnetic field in a faraday medium into homogeneity. Moreover, it is easier to change and control the thickness of a faraday medium, when the wavelength of incident light is fixed.
[0054] Moreover, although it becomes possible in the above-mentioned example to separate the light of two wavelength completely since the include angle of 90deg(s) is given by the faraday rotator FR between wavelength, you may make it give other include angles other than 90deg(s) between wavelength.
[0055] Furthermore, while a magnet becomes unnecessary by using a magnetic garnet as a faraday rotator FR, magnetic shielding also becomes easy and it becomes possible to offer a small and cheap optical decollator.
[0056] Although the faraday rotator was used in the above-mentioned example, other things can be used for instead of further again. The optical fiber which has the Faraday effect is mentioned as an example.
[0057] Although the above-mentioned example showed the thing it was made only for the same include angle to make rotate the plane of polarization of incident light from liquid crystal cell LC, you may make it rotate plane of polarization at a different include angle for every wavelength.
[0058] Moreover, although the above-mentioned example showed the example which used rutile prism, other birefringence components, such as birefringence prism, may be used instead of rutile prism. Polarization is separable by the high extinction ratio using birefringence prism. Moreover, the polarization separation component by structure birefringences, such as a laminating mold polarizer and a polarizer of a diffraction-grating mold, can also be used instead of a birefringence component, and it becomes possible to miniaturize equipment compared with a birefringence component. Furthermore, a polarization beam splitter can also be used instead of a birefringence component.
[0059] As mentioned above, although the case where the light which consists of two wavelength is separated and chosen has been explained, this invention can apply also like a case the case where the light containing three or more wavelength is separated and chosen. For example, if three waves of cases are made into an example, **** of predetermined wavelength can be separated and chosen out of three waves of light by separating into one wave of light, and two waves of light first, and then separating two waves of light.

[0060]
[Effect of the Invention] As explained above, the plane of polarization of incident light is rotated at an include angle which is different for every wavelength component according to this invention, and since it was made the business which separates the wavelength component of the predetermined polarization direction in incident light, it becomes nothing mechanical driving to take out the light of predetermined wavelength possible.

[Translation done.]

* NOTICES *

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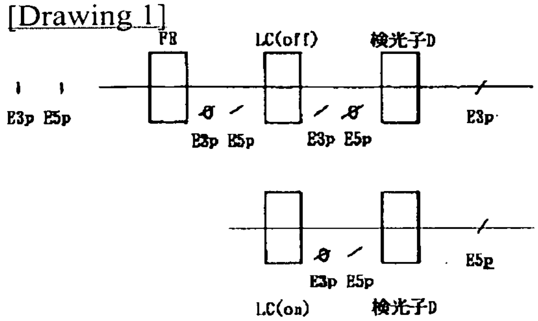
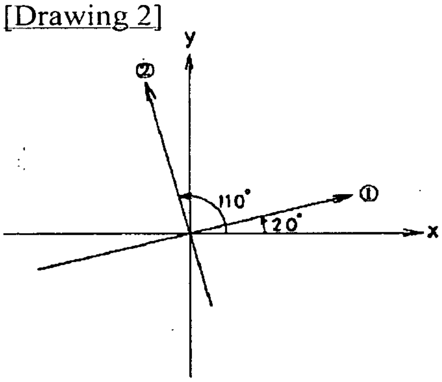
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

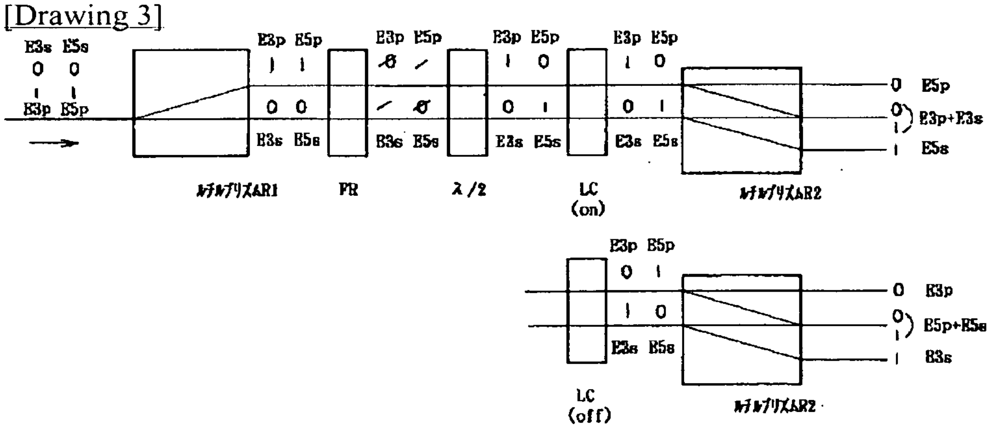
[Drawing 1]



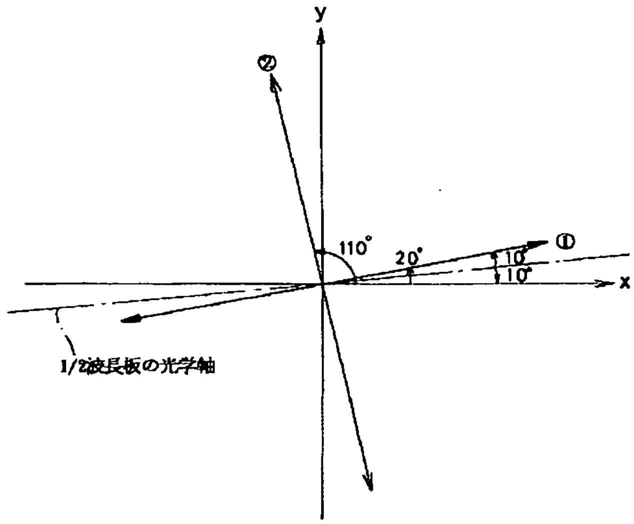
[Drawing 2]



[Drawing 3]



[Drawing 4]



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(11)Publication number : 10-161064
(43)Date of publication of application : 19.06.1998

(51)Int.Cl. G02B 27/28
G02B 27/10
G02F 1/13
G02F 1/1335

(21)Application number : 08-319325
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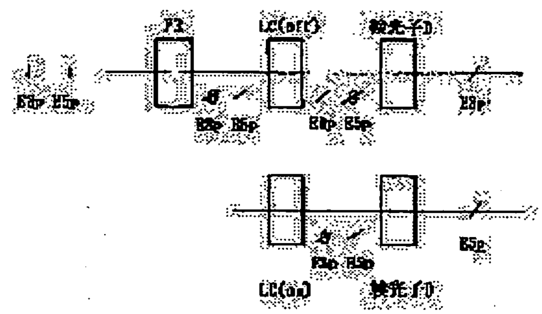
(57)Abstract:
PROBLEM TO BE SOLVED: To provide an alignment-free light separating device and its method which have no mechanical driving part and is hardly affected by temperature variation and temporal variation.
SOLUTION: (p)-Polarized light of 1.3μm in wavelength before being made incident on a Faraday rotator FR is denoted as E3p and (p)-polarized light of 1.5μm in wavelength is denoted as E5p. The direction of polarization of E3p which is made incident on the Faraday rotator FR is rotated by 560deg and the direction of polarization of E5p is rotated by 470deg, so that their azimuth angles of polarization are 20 and 110deg respectively. When E3p and E5p are made incident on a liquid crystal cell LC in an OFF state, they are rotated by 90deg respectively. When E3p and E5p are made incident on an analyzer D, only E3p having the matching azimuth angle of polarization is passed. When E3p and E5p are made incident on the liquid crystal cell LC in an ON state, neither beam changes in the direction of polarization. When E3p and E5p are made incident on the analyzer D, only E5p having the matching azimuth angle of polarization is passed.



LEGAL STATUS
[Date of request for examination]
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision

(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号

特開平10－161064

(43)公開日　平成10年(1998)６月19日

(51)Int.Cl.⁶		識別記号	FI		
Ｇ０２Ｂ	27/28		Ｇ０２Ｂ	27/28	Ｚ
	27/10			27/10	
Ｇ０２Ｆ	1/13	５０５	Ｇ０２Ｆ	1/13	５０５
	1/1335	５１０		1/1335	５１０

審査請求　未請求　請求項の数10　ＯＬ　（全７頁）

(21)出願番号　特願平8－319325

(22)出願日　平成８年(1996)11月29日

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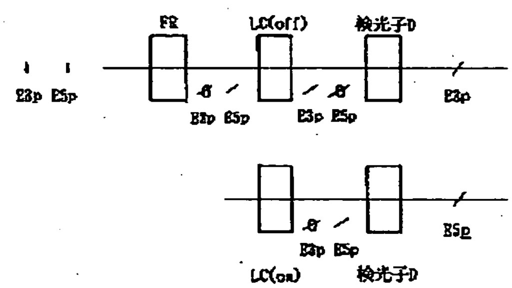
(54)【発明の名称】　光分離装置及びその方法

(57)【要約】

【課題】　機械的駆動部がなく、温度変化や経時変化の影響が受け難く、アライメントフリーな光分離装置及びその方法を提供する。

【解決手段】　ファラデーローテータＦＲへの入射前の、波長１．３μｍのｐ偏光をＥ３ｐ、波長１．５μｍのｐ偏光をＥ５ｐとする。ファラデーローテータＦＲに入射したＥ３ｐの偏光方向は５６０ｄｅｇ回転して、Ｅ５ｐの偏光方向は４７０ｄｅｇ回転して、それぞれの偏光方位角は２０ｄｅｇと１１０ｄｅｇになる。オフ状態の時の液晶セルＬＣに、Ｅ３ｐとＥ５ｐが入射すると、それぞれ９０ｄｅｇずつ回転する。Ｅ３ｐとＥ５ｐが検光子Ｄに入射すると、偏光方位角の一致したＥ３ｐのみが通過する。また、オン状態の時の液晶セルＬＣに、Ｅ３ｐとＥ５ｐが入射すると、それぞれビームの偏光方向は変化しない。Ｅ３ｐとＥ５ｐが検光子Ｄに入射すると、偏光方位角の一致したＥ５ｐのみが通過する。



【特許請求の範囲】

【請求項１】 複数の波長成分を有する入射光の中の１つ又は複数の波長成分を選択して出射する光分離装置において、

波長成分毎に異なる角度で上記入射光の偏波面を回転させて出射する偏波面回転手段と、

この偏波面回転手段を通過した上記入射光の中の所定の偏光方向の上記波長成分を分離する波長成分分離手段とを備えたことを特徴とする光分離装置。

【請求項２】 上記偏波面回転手段が、少なくとも２つの上記波長成分の偏光方向を直交させて出射することを特徴とする請求項１に記載の光分離装置。

【請求項３】 上記偏波面回転手段が、ファラデーローテータであることを特徴とする請求項１又は２に記載の光分離装置。

【請求項４】 上記偏波面回転手段を通過した上記入射光の中の少なくとも２つの上記波長成分の偏光方向を変化させることが可能な偏波面可変手段をさらに備え、

この偏波面可変手段が上記波長成分の偏波面の方向を変化させるか否かによって、上記波長成分分離手段によって分離される上記波長成分を選択することを特徴とする請求項１～３の何れかに記載の光分離装置。

【請求項５】 複数の波長成分を有する入射光の中の１つ又は複数の波長成分を選択して出射する光分離装置において、

上記入射光を互いに直交する偏光方向を有する第１の偏光と第２の偏光とに分離する偏光分離手段と、

波長成分毎に異なる角度で上記第１の偏光の偏波面を回転させて出射する第１の偏波面回転手段と、

この第１の偏波面回転手段を通過した上記第１の偏光の中の所定の偏光方向の上記波長成分を分離する第１の波長成分分離手段と、

波長成分毎に異なる角度で上記第２の偏光の偏波面を回転させて出射する第２の偏波面回転手段と、

この第２の偏波面回転手段を通過した上記第２の偏光の中の所定の偏光方向の上記波長成分を分離する第２の波長成分分離手段とを備えたことを特徴とする光分離装置。

【請求項６】 上記第１の偏波面回転手段が、上記第１の偏光の中の少なくとも２つの上記波長成分の偏光方向を直交させて出射して、

上記第２の偏波面回転手段が、上記第２の偏光の中の少なくとも２つの上記波長成分の偏光方向を直交させて出射することを特徴とする請求項５に記載の光分離装置。

【請求項７】 上記第１及び又は第２の偏波面回転手段が、ファラデーローテータであることを特徴とする請求項５又は６に記載の光分離装置。

【請求項８】 上記第１偏波面回転手段を通過した上記第１の偏光の中の少なくとも２つの上記波長成分の偏光方向を変化させることが可能な第１の偏波面可変手段、

及び又は、上記第２偏波面回転手段を通過した上記第２の偏光の中の少なくとも２つの上記波長成分の偏光方向を変化させることが可能な第２の偏波面可変手段をさらに備え、

この第１及び又は第２の偏波面可変手段が上記波長成分の偏波面の方向を変化させるか否かによって、上記第１及び又は第２の波長成分分離手段によって分離される上記波長成分を選択することを特徴とする請求項５～７の何れかに記載の光分離装置。

【請求項９】 複数の波長成分を有する入射光の中の１つ又は複数の波長成分を選択して出射する光分離方法において、

波長成分毎に異なる角度で上記入射光の偏波面を回転させて、

上記入射光の中の所定の偏光方向の上記波長成分を分離することを特徴とする光分離方法。

【請求項１０】 複数の波長成分を有する入射光の中の１つ又は複数の波長成分を選択して出射する光分離方法において、

上記入射光を互いに直交する偏光方向を有する第１の偏光と第２の偏光とに分けて、

波長成分毎に異なる角度で上記第１の偏光の偏波面を回転させて、上記第１の偏光の中の所定の偏光方向の上記波長成分を分離して、

波長成分毎に異なる角度で上記第２の偏光の偏波面を回転させて、上記第２の偏光の中の所定の偏光方向の上記波長成分を分離することを特徴とする光分離方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、複数の波長成分を有する入射光の中の１つ又は複数の波長成分を選択して出射する光分離装置及びその方法に関し、特に光計測や光情報処理等に適用し得るものである。

【０００２】

【従来の技術】近年、光の性質（位相、偏光、波長等）を利用した高精度の光計測が注目されていて、複数の波長の光が含まれる入射光から所定の波長の光を選択的に取り出す方法が研究されている。

【０００３】従来の光分離方法としては、例えば、回折格子や干渉フィルターを機械的に回転させることにより所定の波長の光を選択的に取り出すものがある。

【０００４】また、このほかにも、ファブリペロー共振器が共振波長のみを透過する特性を利用して、機械的に共振器長を変化させる方法や、内部に液晶等を注入して電気的に屈折率を変化させることによって光路長を変化させる方法があった。

【０００５】

【発明が解決しようとする課題】しかしながら、従来のような機械的な駆動がある場合には、機械的なずれ等により、安定性に問題があった。

【０００６】また、液晶等を用いる方法では、機械的な駆動がなくても．液晶の温度変化や経時変化によって、液晶のギャップが変化して共振波長が安定しないという問題があった。

【０００７】本発明は上記問題点を解決するためになされたものであり．機械的駆動部がなく．温度変化や経時変化の影響が受け難く、アライメントフリーな光分離装置及びその方法を提供することを目的とする。

【０００８】

【課題を解決するための手段】請求項１の発明は．複数の波長成分を有する入射光の中の１つ又は複数の波長成分を選択して出射する光分離装置において、波長成分毎に異なる角度で上記入射光の偏波面を回転させて出射する偏波面回転手段と、この偏波面回転手段を通過した上記入射光の中の所定の偏光方向の上記波長成分を分離する波長成分分離手段とを備えたことを特徴とする。

【０００９】請求項２の発明は、請求項１に記載の光分離装置において．上記偏波面回転手段が、少なくとも２つの上記波長成分の偏光方向を直交させて出射することを特徴とする。

【００１０】請求項３の発明は、請求項１又は２に記載の光分離装置において、上記偏波面回転手段が．ファラデーローテータであることを特徴とする。

【００１１】請求項４の発明は、請求項１～３の何れかに記載の光分離装置において、上記偏波面回転手段を通過した上記入射光の中の少なくとも２つの上記波長成分の偏光方向を変化させることが可能な偏波面可変手段をさらに備え、この偏波面可変手段が上記波長成分の偏波面の方向を変化させるか否かによって．上記波長成分分離手段によって分離される上記波長成分を選択することを特徴とする。

【００１２】請求項５の発明は、複数の波長成分を有する入射光の中の１つ又は複数の波長成分を選択して出射する光分離装置において．上記入射光を互いに直交する偏光方向を有する第１の偏光と第２の偏光とに分離する偏光分離手段と．波長成分毎に異なる角度で上記第１の偏光の偏波面を回転させて出射する第１の偏波面回転手段と．この第１の偏波面回転手段を通過した上記第１の偏光の中の所定の偏光方向の上記波長成分を分離する第１の波長成分分離手段と．波長成分毎に異なる角度で上記第２の偏光の偏波面を回転させて出射する第２の偏波面回転手段と．この第２の偏波面回転手段を通過した上記第２の偏光の中の所定の偏光方向の上記波長成分を分離する第２の波長成分分離手段とを備えたことを特徴とする。

【００１３】請求項６の発明は、請求項５に記載の光分離装置において．上記第１の偏波面回転手段が．上記第１の偏光の中の少なくとも２つの上記波長成分の偏光方向を直交させて出射して．上記第２の偏波面回転手段が．上記第２の偏光の中の少なくとも２つの上記波長成分の偏光方向を直交させて出射することを特徴とする。

【００１４】請求項７の発明は、請求項５又は６に記載の光分離装置において、上記第１及び又は第２の偏波面回転手段が、ファラデーローテータであることを特徴とする。

【００１５】請求項８の発明は、請求項５～７の何れかに記載の光分離装置において、上記第１偏波面回転手段を通過した上記第１の偏光の中の少なくとも２つの上記波長成分の偏光方向を変化させることが可能な第１の偏波面可変手段．及び又は．上記第２偏波面回転手段を通過した上記第２の偏光の中の少なくとも２つの上記波長成分の偏光方向を変化させることが可能な第２の偏波面可変手段をさらに備え、この第１及び又は第２の偏波面可変手段が上記波長成分の偏波面の方向を変化させるか否かによって．上記第１及び又は第２の波長成分分離手段によって分離される上記波長成分を選択することを特徴とする。

【００１６】請求項９の発明は、複数の波長成分を有する入射光の中の１つ又は複数の波長成分を選択して出射する光分離方法において．波長成分毎に異なる角度で上記入射光の偏波面を回転させて、上記入射光の中の所定の偏光方向の上記波長成分を分離することを特徴とする。

【００１７】請求項１０の発明は、複数の波長成分を有する入射光の中の１つ又は複数の波長成分を選択して出射する光分離方法において．上記入射光を互いに直交する偏光方向を有する第１の偏光と第２の偏光とに分けて．波長成分毎に異なる角度で上記第１の偏光の偏波面を回転させて．上記第１の偏光の中の所定の偏光方向の上記波長成分を分離して．波長成分毎に異なる角度で上記第２の偏光の偏波面を回転させて．上記記第２の偏光の中の所定の偏光方向の上記波長成分を分離することを特徴とする。

【００１８】

【発明の実施の形態】以下．本発明による光分離装置及びその方法の実施の形態を図面を参照しながら詳細に説明する。

【００１９】（実施例１）本実施例は．１．３μｍと１．５μｍの２つの波長成分を有する直線偏光を入射して．所定の波長成分を選択的に取り出すときの例である。

【００２０】図１は、本実施例の構成を示したものであり．ファラデーローテータＦＲ、液晶セルＬＣ．検光子Ｄからなる。また、○｜／φはそれぞれ偏光方向を示していて、○は紙面に垂直な方向、｜は○と光軸の両方に垂直な方向、／は○と｜の間の方向．φは／と光軸の両方に垂直な方向を示している。

【００２１】ファラデーローテータは．ヴェルデ定数の波長分散により．波長成分毎に入射光の偏波面を回転させるものである。本実施例のファラデーローテータＦＲ

には、厚さ３９１５μｍのファラデー媒体（ＢｉＹｂＴｂ）３Ｆｅ５Ｏ12を用いた。なお、図示していないが、ファラデー媒体（ＢｉＹｂＴｂ）３Ｆｅ５Ｏ12には、波長１．５μｍの飽和磁場以上の役１１００　Ｏｅ磁場を形成するための磁石を用いた。ファラデーローテータＦＲは、波長１．３μｍの光の偏波面を５６０ｄｅｇ回転させ、波長１．５μｍの光の偏波面を４７０ｄｅｇ回転させる。従って、ファラデーローテータＦＲを通過したときの波長１．３μｍの光と波長１．５μｍの光の偏光方向は、９０ｄｅｇずれている。

【００２２】図２は、ファラデーローテータＦＲを通過したときの、光の進行方向から見たときの偏光方向の状態を示したものである。

【００２３】ファラデーローテータＦＲに入射前の、波長１．３μｍの光と波長１：５μｍの波長の光の偏光方向はｘ軸と平行になっている。ファラデーローテータＦＲを通過したときの波長１．３μｍの光の偏光方向は、５６０（３６０＋２００）ｄｅｇ回転して、図中①で示す方向になる。また、ファラデーローテータＦＲを通過したときの波長１．５μｍの光の偏光方向は、４７０（３６０＋１１０）ｄｅｇ回転して、図中②で示す方向になる。偏光とｘ軸のなす角度、例えば、①とｘ軸のなす角度（図１では２０ｄｅｇ）、②とｘ軸とのなす角度（図１では１１０ｄｅｇ）を、以下偏光方位角と呼ぶ。なお、ファラデーローテータの表裏を逆に用いると、偏波面の回転方向が逆になり、①②はｘ軸を中心とした対称位置になる。

【００２４】液晶セルＬＣは、セル厚が約１０μｍで、基板間で液晶長軸方向が９０ｄｅｇ捻れたツイスト配列のネマティック液晶を用いたものである。液晶セルＬＣは、オフ状態で偏光方位角２０ｄｅｇ及び１１０ｄｅｇの偏光の偏光方向を９０ｄｅｇ回転させ、オン状態では両偏光の偏光方向を変化させないように配置している。

【００２５】検光子Ｄは、所定の偏光方位角の偏光のみを通過させるものであり、本実施例では、偏光方位角１１０ｄｅｇの偏光を通過するように設定した。

【００２６】このような構成で、波長１．３μｍと１．５μｍのｐ偏光（｜の方向）が入射した場合を例にして説明する。ファラデーローテータＦＲへの入射前の、波長１．３μｍのｐ偏光をＥ３ｐ、波長１．５μｍのｐ偏光をＥ５ｐとする。

【００２７】ファラデーローテータＦＲに入射したＥ３ｐのビームの偏光方向は５６０ｄｅｇ回転して、Ｅ５ｐのビームの偏光方向は４７０ｄｅｇ回転して、それぞれの偏光方位角は２０ｄｅｇと１１０ｄｅｇになる。

【００２８】オフ状態の時の液晶セルＬＣに、Ｅ３ｐのビームとＥ５ｐのビームが入射すると、それぞれ９０ｄｅｇずつ回転する。Ｅ３ｐのビームとＥ５ｐのビームが検光子Ｄに入射すると、偏光方位角の一致したＥ３ｐのビームのみが通過する。

【００２９】また、オン状態の時の液晶セルＬＣに、Ｅ３ｐのビームとＥ５ｐのビームが入射すると、それぞれビームの偏光方向は変化しない。Ｅ３ｐのビームとＥ５ｐのビームが検光子Ｄに入射すると、偏光方位角の一致したＥ５ｐのビームのみが通過する。

【００３０】このように、液晶セルのＬＣのオン・オフにより、取り出す光の波長を選択することができる。

【００３１】以上のように本実施例によれば、ファラデーローテータＦＲで入射光の偏光方向を波長成分毎に回転して、検光子Ｒで所定の偏光方位角の偏光のみを通過させるようにしたので、機械的駆動無しで、所定の波長の光を取り出すことが可能になる。さらに、液晶セルＬＣを用いることで、取り出す光の波長を選択する（切り替える）ことが可能になる。

【００３２】また、ファラデーローテータＦＲによって波長間に９０ｄｅｇの角度がつけられているために、２つの波長の光を完全に分離することが可能になる。

【００３３】本実施例の光分離装置は、従来の装置に比べ温度変化や経時変化の影響を受け難い。

【００３４】（実施例２）本実施例は、１．３μｍと１．５μｍの２つの波長成分を有する光（直線偏光でなくてもよい）を入射して、所定の波長成分を選択的に取り出すときの例である。

【００３５】図３は、本実施例の構成を示したものであり、２つのルチルプリズムＲ１，Ｒ２，ファラデーローテータＦＲ、及び１／２波長板λ／２と液晶セルＬＣからなる。また、○｜／φはそれぞれ偏光方向を示していて、○は紙面に垂直な方向、｜は○と光軸の両方に垂直な方向、／は○と｜の間の方向、φは／と光軸の両方に垂直な方向を示している。

【００３６】第１のルチルプリズムＲ１は、入射光を互いに直交する偏光方向を有する２つの偏光（ｓ偏光とｐ偏光）に分離するものである。

【００３７】ファラデーローテータは、ヴェルデ定数の波長分散により、波長成分毎に光の偏波面を回転させるものである。本実施例のファラデーローテータＦＲには、厚さ３９１５μｍのファラデー媒体（ＢｉＹｂＴｂ）３Ｆｅ５Ｏ12を用いた。なお、図示していないが、ファラデー媒体（ＢｉＹｂＴｂ）３Ｆｅ５Ｏ12には、波長１．５μｍの飽和磁場以上の役１１００　Ｏｅ磁場を形成するための磁石を用いた。ファラデーローテータＦＲは、波長１．３μｍの光の偏波面を５６０ｄｅｇ回転させ、波長１．５μｍの光の偏波面を４７０ｄｅｇ回転させる。従って、ファラデーローテータＦＲを通過したときの波長１．３μｍの光と波長１．５μｍの光の偏光方向は、９０ｄｅｇずれている。

【００３８】１／２波長板λ／２は、偏光方向を回転させるものである。図４を参照しながら、その詳細を説明する。１／２波長板λ／２に入射前の波長１．３μｍの光の偏光方向は図中①で示す方向（偏光方位角２０ｄｅ

g）．波長1．5μmの光の偏光方向は図中②で示す方向（偏光方位角110deg）になっている。本実施例では．1／2波長板λ／2を、その光学軸がx軸に対して10deg傾いた角度に設置する。1／2波長板λ／2は入射光の偏光方向を光学軸に対して対称な位置にして出射する特性があるので．1／2波長板λ／2を通過すると、①の方向の光はx軸と平行に．②の方向の光はy軸と平行になる。つまり．1／2波長板λ／2を通過した波長1．3μmの光と波長1．5μmの光の偏光方位角はともに－20deg回転する。

【0039】液晶セルLCは、セル厚が約10μmで、基板間で液晶長軸方向が90deg捻れたツイスト配列のネマティック液晶を用いたものである。液晶セルLCは．オフ状態で偏光方位角20deg及び110degの偏光の偏光方向を90deg回転させ、オン状態では両偏光の偏光方向を変化させないように配置している。

【0040】第2のルチルプリズムR2は、分離した光を合波するものであり、第1のルチルプリズムR1と同じものを裏返しにして用いた。

【0041】このような構成で、波長1．3μmと1．5μmの光が入射した場合を例にして説明する。ファラデーローテータFRへの入射前の、波長1．3μmのs偏光をE3s．p偏光をE3p、波長1．5μmのs偏光をE5s、p偏光をE5pとする。

【0042】まず、第1のルチルプリズムR1により入射光は、s偏光（E3s．E5s）とp偏光（E3p．E5p）に分離される。

【0043】ファラデーローテータFRに入射したE3sとE3pのビームの偏光方向は560deg回転して．E5sとE5pのビームの偏光方向は470deg回転して、それぞれの偏光方位角は20degと110degになる。

【0044】次に、それぞれのビームE3s．E5s．E3p．E5pが1／2波長板λ／2に入射するとそれぞれ偏光方位角は－20deg回転して、E3sとE3pのビームの偏光方位角は0degになり、E5sとE5pのビームの偏光方位角は90degになる。

【0045】オフ状態の時の液晶セルLCに、それぞれのビームE3s．E5s．E3p．E5pが入射すると．それぞれ90degずつ回転して．E3pとE5sは第2のルチルプリズムR2に対してs偏光となり、第2のルチルプリズムR2をまっすぐに透過する。一方、E3sとE5pは第2のルチルプリズムR2に対してp偏光となり、第2のルチルプリズムR2の中で光路が曲げられる。その結果、第2のルチルプリズムR2からはE3p、E5s＋E5p．E3sの3本のビームが出射されることになり、E5s＋E5pは入射光の中の波長1．5μmの光が取り出されたものになる。

【0046】また、オン状態の時の液晶セルLCに、それぞれのビームE3s．E5s．E3p．E5pが入射すると、それぞれビームの偏光方向は変化しないので、E3sとE5pは第2のルチルプリズムR2に対してs偏光となり、第2のルチルプリズムR2をまっすぐに透過する。一方．E3pとE5sは第2のルチルプリズムR2に対してp偏光となり．第2のルチルプリズムR2の中で光路が曲げられる。その結果．第2のルチルプリズムR2からはE5p、E3s＋E3p、E5sの3本のビームが出射されることになり、E3s＋E3pは入射光の中の波長1．5μmの光が取り出されたものになる。

【0047】このように．液晶セルのLCのオン・オフにより、取り出す光の波長を選択することができる。

【0048】以上のように本実施例によれば、第1のルチルプリズムR1でs偏光とp偏光に分離して．ファラデーローテータFRで光の偏光方向を波長成分毎に回転して．1／2波長板λ／2で偏光方位角を調整して、第2のルチルプリズムで光を合波するようにしたので、機械的駆動無しで．所定の波長の光を取り出すことが可能になる。本実施例では、入射光は、直線偏光でなくてもよい。さらに．液晶セルLCを用いることで、取り出す光の波長を選択する（切り替える）ことが可能になる。

【0049】本実施例の光分離装置は．従来の装置に比べ温度変化や経時変化の影響を受け難い。

【0050】本発明は、上記の実施例に限定されるものでなく、種々の変形を許容するものである。

【0051】上記実施例では、波長1．3μmの光と波長1．5μmの光を例にして説明したが、本発明は、他の波長の光にも同様に適用できる。例えば、波長633nm．515nmのHeNeレーザ光とアルゴンレーザ光とを分離選択にも同様に適用できる。

【0052】また、ファラデー媒体の種類、及びその厚さに関しても．上記実施例で示した以外の他のものを用いてもよい。

【0053】上記実施例では、飽和磁場を用いたためにファラデー媒体の厚みを規定して偏波面の回転角を制御するようにしたが、磁場を変えることによって回転角を制御するようにしてもよい。ただし．磁場を変える場合は．ファラデー媒体中の磁場を均一に変えることが好ましい。また、入射光の波長が一定の場合は、ファラデー媒体の厚みを変えて制御するほうが容易である。

【0054】また上記実施例では、ファラデーローテータFRによって波長間に90degの角度がつけられているために、2つの波長の光を完全に分離することが可能になるが、波長間に90deg以外の他の角度をつけるようにしてもよい。

【0055】さらに、ファラデーローテータFRとして磁性ガーネットを用いることにより．磁石が不要になるとともに、磁気シールドも容易になり．小型で安価な光分離装置を提供することが可能になる。

【0056】さらにまた．上記実施例ではファラデーロ

ーテータを使用したが、代わりに他のものを用いることができる。例としては、ファラデー効果を有する光ファイバが挙げられる。

【００５７】上記実施例では、液晶セルＬＣより、入射光の偏波面を同じ角度だけ回転させるようにしたものを示したが、波長毎に異なる角度で偏波面を回転させるようにしてもよい。

【００５８】また、上記実施例では、ルチルプリズムを用いた例を示したが、ルチルプリズムの代わりに複屈折プリズム等の他の複屈折素子を用いてもよい。複屈折プリズムを用いることで、高い消光比で偏光を分離することができる。また、複屈折素子の代わりに積層型偏光子、回折格子型の偏光子等の構造複屈折による偏光分離素子を使用することもでき、複屈折素子に比べ装置を小型化することが可能になる。さらに、複屈折素子の代わりに偏光ビームスプリッタを使用することもできる。

【００５９】以上、２つの波長からなる光を分離、選択する場合を説明してきたが、本発明は、３つ以上の波長を含む光を分離、選択する場合を場合にも同様に適用できる。例えば３波長の場合を例にすると、まず１波長の光と２波長の光とに分離して、次に２波長の光を分離することにより、３波長の光の中から所定の波長の光をを分離、選択することができる。

【００６０】

【発明の効果】以上説明したように本発明によれば、波長成分毎に異なる角度で入射光の偏波面を回転させて、入射光の中の所定の偏光方向の波長成分を分離する用にしたので、機械的駆動無しで、所定の波長の光を取り出すことが可能になる。

【図面の簡単な説明】

【図１】実施例１に係る光分離装置の構成を示す図である。

【図２】ファラデーローテータによる偏光方向の回転を示す図である。

【図３】実施例２に係る光分離装置の構成を示す図である。

【図４】１／２波長板による偏光方向の回転を示す図である。

【符号の説明】

ＦＲ　ファラデーローテータ

ＬＣ　液晶セル

Ｄ　検光子

λ／２　１／２波長板

Ｒ１、Ｒ２　ルチルプリズム

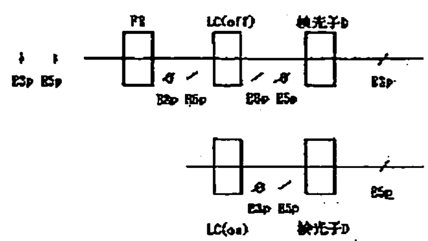
Ｅ３ｓ　波長１．３μｍのｓ偏光

Ｅ３ｐ　波長１．３μｍのｐ偏光

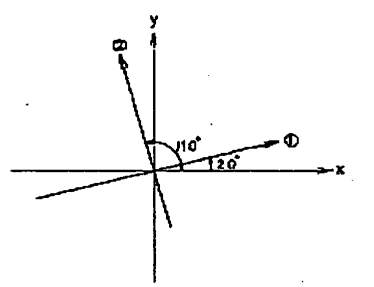
Ｅ５ｓ　波長１．５μｍのｓ偏光

Ｅ５ｐ　波長１．５μｍのｐ偏光

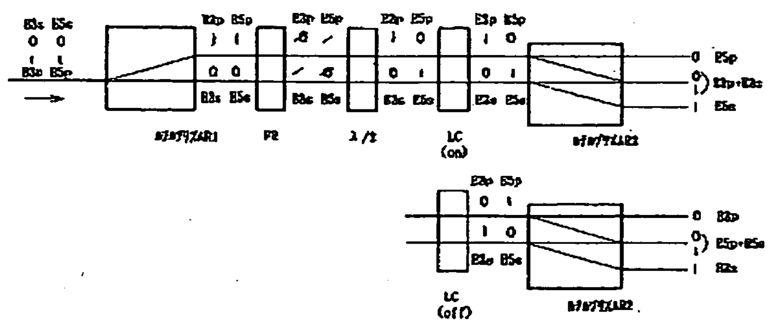
【図１】



【図２】



【図３】



【図４】